MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (TERM ID 2215)

DRT5111 – INTRODUCTION TO REAL-TIME SYSTEMS

(DIT)

20 FEBRUARY 2023
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **3** pages with **2** sections.
2. Answer **ALL** questions.
3. Write your answers in the answer booklet provided.

Section A: Fill in the blanks (Total: 20 Marks)

Instruction: *Fill in the blanks with the terms given in the table. Answer **ALL** the questions in the Answer Booklet provided.*

synchronization	threads	binary	malloc	execution
memory pool	dependency	circular	blocked	idle
memory location	counting	soft constraints	requestor	RAM
satisfied	JTAG	CPU	loader	modular
resource	starvation	built-in mechanism	activity	event register

1. _____ are often expressed statistically and an example is Automated Teller Machine (ATM). **[1m]**

2. Real Time System is not meant to be fast but it should be just fast enough to ensure that all functional requirements, constraints, and timing requirements are _____. **[1m]**

3. _____ is a program used to download image from the host system for the target side. **[1m]**

4. Downloading the image through a _____ **interface** is one of way to load an image to a target embedded system. **[1m]**

5. Message queues are buffer-like data structures that can be used for _____, mutual exclusion, and data exchange by passing messages between tasks. **[1m]**

6. Real Time Operating System should be able to add or delete _____ components depending on how much functionality is required. **[1m]**

7. _____ state happens when the task has requested a resource that is not available, or has requested to wait until some event occurs, or has delayed itself for some duration. **[1m]**

8. CPU _____ refers to a situation when higher priority tasks use all of the CPU execution time and lower priority tasks do not get to run. **[1m]**

Continued...

9. A semaphore is a kernel object that one or more _____ of execution can acquire or release for the purposes of synchronization or mutual exclusion. **[1m]**

10. _____ semaphore uses count to allow the semaphore to be acquired or released multiple times. **[1m]**

11. _____ consists of a group of binary event flags used to track the occurrence of specific events. **[1m]**

12. One of limitations of event register is the _____ to identify source of an event if multiple sources are possible is absent. **[1m]**

13. In memory-mapped I/O machine instructions coded to transfer data between _____and CPU or between two memory locations can be used to access the I/O device. **[1m]**

14. Direct Memory Access (DMA) chips or controllers allow device to access the memory directly without involving the _____. **[1m]**

15. Dynamic memory allocation function or _____ specify size of the allocation request in bytes. **[1m]**

16. In fixed size memory management, each _____ control structure maintains information e.g. block size, total number of blocks, and number of free blocks. **[1m]**

17. _____ synchronization determine whether the execution of a multithreaded program has reached a certain state. **[1m]**

18. A resource server is a central entity that accept access request and grant permission to the _____ before they can access the shared resource. **[1m]**

19. Priority inversion occurs when task _____ exists among tasks with different priorities. **[1m]**

20. Resource access control protocol is a protocol governs the _____ property of the ask holding the resources. **[1m]**

Continued...

Section B: Structured Questions, 2 Questions (Total: 20 Marks)
Instruction: *Answer **ALL** the questions in the Answer Booklet provided.*

QUESTION 1 (10 Marks)

a) Synchronization is classified into two categories which are resource synchronization and activity synchronization. Differentiate between these two categories. [4 Marks]

b) Tasks communicate with one another so that they can pass information to each other and coordinate their activities in a multithreaded embedded application. Communication can be signal-centric, data-centric, or both.
   i. State definition of signal-centric and data-centric [2 Marks]
   ii. State **FOUR (4)** communication purposes. [4 Marks]

QUESTION 2 (10 Marks)

a) Define and briefly explain deadlock. State and explain **TWO (2)** conditions that cause deadlock situation. [6 Marks]

b) In embedded systems, resources are shared among various concurrently executing tasks. State and explain **TWO (2)** type of resource classification. [4 Marks]

End of Page